Remarks

Claims 1-64 remain pending in the present application. Claim 6 has been objected to as depending from a rejected claim, but deemed allowable with the recitations of claim 1 Claims 21 and 64 are objected to as depending from a rejected claim, but deemed allowable with the recitations of the claims from which they depend. Claims 45, 53-58 and 60-61 are objected to under 35 U.S.C. §112, first paragraph, but deemed allowable if amended to remove such objection.

Claims 1-4, 7, 11-16, 19-20, 31-32, 34, 38-41 and 62-63 are rejected under 35 U.S.C. §103(a) as being unpatentable over Junk, U.S. Patent No. 6,128,541, in view of Zou et al., U.S. Patent No. 5,691,896, in further view of Graham et al., U.S. Patent No. 5,144,595.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Junk, U.S. Patent No. 6,128,541, in view of Zou et al., U.S. Patent No. 5,691,896, in further view of Graham et al., U.S. Patent No. 5,144,595, as applied to claim 1 above, and in further view of Plummer, U.S. Patent No. 5,268,625.

Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Junk, U.S. Patent No. 6,128,541, in view of Zou et al., U.S. Patent No. 5,691,896, in further view of Graham et al., U.S. Patent No. 5,144,595, as applied to claim 1 above, and in further view of Official Notice.

Official Notice is taken with respect to a laptop, or portable type computer, in communication with a control system. This system is well known in the art and is useful for allowing remote configuration and or operations/diagnosis for a control system, and this would have been obvious to one of ordinary skill in the art at the time the invention was made.

Claims 17-18, 22-24, 33, 46 and 49 are rejected as being unpatentable over Junk, U.S. Patent No. 6,128,541, in view of Zou et al., U.S. Patent No. 5,691,896, in further view of Graham et al., U.S. Patent No. 5,144,595, as applied to claim 1 above, and in further view of de Ward et al., U.S. Patent No. 6,207,936.

As per method claims, 25, 26-29, 30, 35, 36, 37, 42-44, 47-48 and 50-52, the rejection of at least system claims 1, 17-18 and 22 is applied equally herein. The method claims merely reproduce the specific steps already contemplated by the rejection of of at

least claims 1, 17-18 and 22, set forth above in this office action. In addition, any features not covered by the rejection of the aforementioned claims are believed to be inherent to the adaptive control system contemplated by Junks' combined system.

As noted in the Specification of the above captioned application, according to aspects of an embodiment of the present invention:

> [0007] The shortcomings of active control are especially appreciated when taken from a predictable laboratory setting to the rigors of the factory floor. In laboratory tests, one can characterize the system being controlled, including experimentally induced disturbances, before closing the loops and then adjust the control gains to get the best possible response out of the system. In this manner, it is possible to eliminate much of the uncertainty about a system's input/output behavior in a specified frequency range, especially when using modem system identification techniques. In real world applications, however, it is more difficult to recreate system performance identical to that observed in the lab. Part-to-part variation results in differences in response to control inputs, even between nominally identical systems, and even when using the same controller. Changes in environment and equipment configuration can cause sometimes difficult to pinpoint modeling errors because they can vary from location to location and may also vary with time. These issues often arise in the case of semiconductor fabrication equipment, where the dynamics of the individual system may not be completely known until it has been deployed and used in the factory. Furthermore, the exact character of a disturbance in physical conditions, let alone specific disturbance frequencies, may not be known ahead of time with the precision needed to optimize performance and can be time-varying themselves.
> [0008] Researchers have been addressing these issues outside of the semiconductor industry by applying adaptive control techniques to the structural control problem. The thrust of these efforts has been to make the adaptive control algorithms as general as possible, with the goal of making a controller which uses an unchanging theoretical model to work for all conceivable systems under all conditions. Such an ideal controller usually is necessarily (and undesirably) complex for most practical applications and, in use, may limit the performance of

the controller. In addition, if the model of the plant changes as a function of time, the performance of the controller may be limited if these changes are not captured in the model.

[0009] Some research in the area of adaptive control has focused on its application to flexible structures. Roughly, the favored approaches of these efforts can be divided into three classes of feedback control: direct adaptive control, self tuning regulators, and tonal controllers. The direct adaptive controllers compute control gains "adaptively", i.e., directly from measurement errors. In general, these types of controllers guarantee stability via Lyapunov theory. However, direct controllers usually require that actuators and sensors be collocated and dual to enforce a positive real condition in the transfer functions. In practice, it is often difficult to construct sensor/actuator pairs that yield truly positive real behavior. Either non-idealities, such as amplifier dynamics, violate the condition, or the collocation of actuators and sensors forces an unsatisfactory reduction in closed-loop performance.

[0010] Tonal controllers are those designed to perform disturbance rejection at one or several discrete frequencies. The disturbance is usually a sinusoid, usually of unknown frequency. The tonal controller typically either adapts to changes in frequency, changes in plant dynamics, or both. This type of control can achieve perfect disturbance rejection (even in non-positive-real systems) in instances where the number of error sensors is less than or equal to the number of actuators and the actuators have sufficient control authority. Self tuning regulators add an extra step to the adaptation process, namely, the adaptive updating of an internal model in the tuning algorithm. This model is used to compute control gains. These methods generally do not require collocation, and are distinguished from each other primarily by the algorithm used to perform identification (ID) of the internal model. Among the ID methods used in these types of controllers are neural nets, modal parameters, physical structural properties (e.g. mass and stiffness) and families of models that span the parameter variation space. (Denoted paragraphs in the Published Application 20030028266, published on February 6, 2003, and pp.

In addition the specification of the above captioned application notes that according to aspects of an embodiment of the present invention:

[0028] The systems and methods of the invention extend, for example, to fabrication equipment and robotic systems and to dealing with servo and tracking problems. The invention, in one regard, contemplates its application to command following, and does so in a sufficiently timely manner to allow it to be implemented in a typical semiconductor fabrication facility, although the invention is equally applicable to other scenarios, such as typical disturbance rejection problems. Thus, according to one aspect of the invention, a motion control system responds to some event, such as an operator command or automated detection of degraded performance by shifting the system into data acquisition mode. Such events, by way of example, might occur simply as a product of routine maintenance and/or daily line or plant shutdowns, or may occur in case of more serious, equipment malfunction-related causes. In this mode, transfer function data is collected by injecting signals into all relevant actuators and taking measurements from all sensors of interest. The data is collected in either an open or closed loop fashion. Using the previous model as an initial guess, the new data is used to update the model parameters. This is done by using non-linear curve fitting techniques to fit the log magnitude and phase of the transfer function data. (Denoted paragraph of the Published Application 20030028266, published on February 6, 2003, and pp.

In addition the specification of the above captioned application notes that according to aspects of an embodiment of the present invention:

[0034] The process of updating an internal model to match measured data is system identification ("ID"). In a one possible embodiment, system ID is performed using **transfer** function data collected between key actuators and sensors in the system. (Denoted paragraphs in the Published Application 20030028266, published on February 6, 2003, and pp.

In addition the specification of the above captioned application notes that according to aspects of an embodiment of the present invention:

[0040] The error terms in this case are the logarithmic transfer function error for each actuator, sensor and frequency of interest. (Denoted paragraphs in the Published Application 20030028266, published on February 6, 2003, and pp.

In addition the specification of the above captioned application notes that according to aspects of an embodiment of the present invention:

[0044] The system ID method used in the invention, such as the one described above, offers several advantages. For example, since it is based on transfer function data, the quality of the fit can be adjusted based upon frequency range. Thus, the model can be generated to match the data closely in frequency ranges important for control design (e.g., near the loop gain crossover frequency), and allowed to merely approximate the data in frequency ranges where the model information is not important (i.e. frequencies where the control gains have been rolled off). Another advantage stems from the fact that the algorithm includes log magnitude and phase explicitly in the error function used for curve fitting, quantities that are important to good control design. Yet another advantage of the ID method used in the invention is that the model parameterization, cost function, and curve fitting algorithm together have a very good region of convergence. As a result, the algorithm recovers the optimal fit to the data even when the initial guess has very large errors. (Denoted paragraphs in the Published Application 20030028266, published on February 6, 2003, and pp.

The above explanation of aspects of an embodiment of the present invention is different from the utilization of transfer functions in Junk, as noted in the Specification of Junk:

As illustrated in FIG. 2, the controller 44 includes a summer 46 that subtracts signals developed by five feedback paths from the reference signal r to develop an error signal on a forward path. The forward path includes an amplifier 48 that multiples the error signal by a gain K_1 and delivers the output of the amplifier 48 to the I/P transducer 36 as the control or drive signal u. The first feedback path of the controller 44 includes a transfer function block 50 sensitive to the relay travel v and an amplifier 51 that multiplies the output of the block 50 by a gain K_2. The second feedback path includes a transfer function block 52

sensitive to the air flow w and an amplifier 53 that multiplies the output of the block 52 by a gain K_4. Likewise, the third feedback path includes a transfer function block 54 sensitive to the actuator pressure p and an amplifier 55 that multiplies the output of the block 54 by a gain K_4 while the fourth feedback path includes a transfer function block 56 sensitive to the valve position z and an amplifier 57 that multiplies the output of the block 56 by a gain K_5. The fifth feedback path simply provides the valve position z to the summer 46. As will be understood, the transfer function blocks 50, 52, 54 and 56 may be, for example, filters, and may implement any desired type(s) of transfer functions. Of course, the specifics of the controller 44 of FIG. 2 are merely exemplary, it being understood that other feedback and forward paths could be alternatively or additionally used and that the controller 44 could implement any other type of control scheme including, for example, a proportional-integral (PI) control scheme, a proportional-integral-derivative (PID) control scheme, an internal model control (IMC) scheme, etc.

Claims 1, 18, 22, 25, 26, 29-39 and 46-52 have been amended to reflect this difference and therefore the Examiner's rejection of these claims and the claims that depend from them is improper and these claims and the claims that depend from them should therefore be allowable. The Examiner is respectfully requested to allow claims 1, 18, 22, 25, 26, 29-39 and 46-52 and the claims that depend from them.

Claim 10 has been objected to. Claim 10 has been cancelled.
claims 18, 22, 33, 46, 47, 48, 49, 50, 51 and 52 have been objected to, for reasons that are not apparent to applicant. There is not a specific reference to 35 U.S.C. §112, first paragraph and the Examiner concludes that the recitation objected to, fuly coupled" is simply not given patentable weight. Applicant submits that persons of ordinary skill in the art, based on the specification of the above captioned application will understand what "fully coupled" means in the context of the disclosure of the Specification and the utilization of the term in the respective claims along with the context of other claims.

Claims 1-18, 32, 45 and 49 have been rejected under 35 U.S.C. §112, first paragraph. Claims 1-18, 32, 45 and 49 have been amended to render this rejection

improper and the Examiner is respectfully requested to withdraw this rejection and allow claims 1-18, 32, 45 and 49.

Claim 65 has been added to recite the allowable subject matter from claim if claim 6 as an independent claim with the recitations of claim 1, from which claim 6 depended in its allowed form.

Claim 1, and consequently also newly submitted claims 65 and 67, have been amended to recite "acquired data" to be consistent and have proper antecedent basis with the remainder of the claim.

Atty. Docket No. 2001-0093-01
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Conclusion

Applicant believes that claims 1-64 now stand in condition for allowance and respectfully requests the Examiner to allow these claims. Applicant hereby requests a three month extension of time to respond to the above referenced Office Action and authorizes the commissioner to charge applicants' assignee's Deposit Account, of Cymer Inc., Deposit Account No. 03-4060 the amount of $1,020 for the three month extension of time. Applicants do not believe that any additional fees or charges are due for the continued prosecution of the above referenced application but if any such are due the commissioner is hereby authorized to charge the referenced Deposit Account for any such additional fees or charges.

Respectfully submitted,

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